

-12-

Claims:

1. An electroactive device, comprising:
at least two layers of material, each layer having a length, width and
5 thickness dimension; wherein at least one layer is an electroactive material
and wherein at least one layer is of non-uniform thickness; and
means for bonding the layers to one another.
2. The electroactive device of claim 1, wherein the at least one
10 layer of electroactive material further comprises means to supply electrical
signals across the thickness thereof.
3. The electroactive device of claim 2, wherein the means to
supply electrical signals is at least one electrode positioned on each of the
15 upper and lower surfaces of the at least one layer of electroactive material.
4. The electroactive device of claim 3, wherein the at least one
electrode is a conductive polymer material having elasticity comparable to the
at least one layer of electroactive material and having good adherence to the
20 at least one electroactive material.
5. The electroactive device of claim 2, wherein the applied
amplitude of the electrical signals controls the range of device motion.
- 25 6. The electroactive device of claim 1, wherein the at least one
non-uniform thickness layer enables a controlled contouring of the activated
device.
7. The electroactive device of claim 6, wherein the controlled
30 contouring comprises bending of the activated device.

-13-

8. The electroactive device of claim 6, wherein the controlled contouring comprises torsion of the activated device.

9. The electroactive device of claim 1, wherein the non-uniform thickness of at least one layer is a function of at least one dimension of the layer.

10. The electroactive device of claim 1, wherein the non-uniform thickness of at least one layer is a function of both the length and width of the layer.

11. The electroactive device of claim 1, wherein two or more layers of material are electroactive.

12. The electroactive device of claim 1, wherein one layer of material is non-electroactive.

13. The electroactive device of claim 12, wherein the non-electroactive material is selected from the group consisting of polymers, ceramics, composites and metals.

14. The electroactive device of claim 1, wherein the electroactive material is a material that responds to electrical activation.

15. The electroactive device of claim 1, wherein the electroactive material is selected from the group consisting of polymers, ceramics, and composites.

-14-

16. The electroactive device of claim 1, wherein the electroactive material is an electrostrictive graft elastomer comprising a backbone molecule which is a non-crystallizable, flexible macromolecular chain, and a grafted polymer forming polar graft moieties with backbone molecules, the polar graft moieties having been rotated by an applied electric field and sustained in the rotated state until the electric field is removed.

17. The electroactive device of claim 1, wherein the cross-section of at least one non-uniform layer is defined by a function of the distance along the length of the layer.

18. The electroactive device of claim 1, wherein the cross-section of at least one non-uniform layer is defined by a function of the distance along the width of the layer.

19. The electroactive device of claim 1, wherein the cross-section of at least one non-uniform layer is defined by a function of both the distance along the length of the layer and the distance along the width of the layer.

20. The electroactive device of claim 1, wherein the layers of the device are conformable for use in folded deployable devices.

21. The electroactive device of claim 1, wherein the means for bonding the layers is selected from the group consisting of chemical bonding, physical bonding, mechanical bonding, and biological bonding.

22. An electroactive device as claimed in claim 1, wherein the means for bonding the layers is a chemical bonding means employing a chemical adhesive.

30

-15-

23. The electroactive device of claim 1, wherein the device itself is a membrane to be deformed.

24. The electroactive device of claim 23, wherein the membrane is
5 a reflector.

25. The electroactive device of claim 1, wherein at least one device is positioned along the surface of a structure to modify the surface's contour.

26. The electroactive device of claim 25, wherein the surface to be
10 modified is a skin surface.

27. The electroactive device of claim 26, wherein the device produces traveling waves.
15

28. The electroactive device of claim 25, wherein the surface to be modified is a display panel.

29. The electroactive device of claim 25, wherein the surface to be
20 modified is an optical index layer for a liquid crystal display.

30. The electroactive device of claim 1, wherein at least one device is integrated within the surface of a structure to modify the surface's contour.

31. The electroactive device of claim 30, wherein the surface to be
25 modified is a skin surface.

32. The electroactive device of claim 30, wherein the device produces traveling waves.
30

33. The electroactive device of claim 1, wherein the device performs at least one function selected from the group consisting of shaping, tuning, positioning, controlling and deforming.

5 34. The electroactive device of claim 1, wherein the device is a component of a micro-electromechanical system.

35. The electroactive device of claim 1, wherein the device is a component of a nano-electromechanical system.

項目	単位	1990年	1991年	1992年	1993年	1994年	1995年	1996年	1997年	1998年	1999年	2000年	2001年	2002年	2003年	2004年	2005年	2006年	2007年	2008年	2009年	2010年	2011年	2012年	2013年	2014年	2015年	2016年	2017年	2018年	2019年	2020年	2021年	2022年	2023年	2024年	2025年	2026年	2027年	2028年	2029年	2030年	2031年	2032年	2033年	2034年	2035年	2036年	2037年	2038年	2039年	2040年	2041年	2042年	2043年	2044年	2045年	2046年	2047年	2048年	2049年	2050年	2051年	2052年	2053年	2054年	2055年	2056年	2057年	2058年	2059年	2060年	2061年	2062年	2063年	2064年	2065年	2066年	2067年	2068年	2069年	2070年	2071年	2072年	2073年	2074年	2075年	2076年	2077年	2078年	2079年	2080年	2081年	2082年	2083年	2084年	2085年	2086年	2087年	2088年	2089年	2090年	2091年	2092年	2093年	2094年	2095年	2096年	2097年	2098年	2099年	2100年																																																																		
総人口	人	12,100,000	12,200,000	12,300,000	12,400,000	12,500,000	12,600,000	12,700,000	12,800,000	12,900,000	13,000,000	13,100,000	13,200,000	13,300,000	13,400,000	13,500,000	13,600,000	13,700,000	13,800,000	13,900,000	14,000,000	14,100,000	14,200,000	14,300,000	14,400,000	14,500,000	14,600,000	14,700,000	14,800,000	14,900,000	15,000,000	15,100,000	15,200,000	15,300,000	15,400,000	15,500,000	15,600,000	15,700,000	15,800,000	15,900,000	16,000,000	16,100,000	16,200,000	16,300,000	16,400,000	16,500,000	16,600,000	16,700,000	16,800,000	16,900,000	17,000,000	17,100,000	17,200,000	17,300,000	17,400,000	17,500,000	17,600,000	17,700,000	17,800,000	17,900,000	18,000,000	18,100,000	18,200,000	18,300,000	18,400,000	18,500,000	18,600,000	18,700,000	18,800,000	18,900,000	19,000,000	19,100,000	19,200,000	19,300,000	19,400,000	19,500,000	19,600,000	19,700,000	19,800,000	19,900,000	20,000,000	20,100,000	20,200,000	20,300,000	20,400,000	20,500,000	20,600,000	20,700,000	20,800,000	20,900,000	21,000,000	21,100,000	21,200,000	21,300,000	21,400,000	21,500,000	21,600,000	21,700,000	21,800,000	21,900,000	22,000,000	22,100,000	22,200,000	22,300,000	22,400,000	22,500,000	22,600,000	22,700,000	22,800,000	22,900,000	23,000,000	23,100,000	23,200,000	23,300,000	23,400,000	23,500,000	23,600,000	23,700,000	23,800,000	23,900,000	24,000,000	24,100,000	24,200,000	24,300,000	24,400,000	24,500,000	24,600,000	24,700,000	24,800,000	24,900,000	25,000,000	25,100,000	25,200,000	25,300,000	25,400,000	25,500,000	25,600,000	25,700,000	25,800,000	25,900,000	26,000,000	26,100,000	26,200,000	26,300,000	26,400,000	26,500,000	26,600,000	26,700,000	26,800,000	26,900,000	27,000,000	27,100,000	27,200,000	27,300,000	27,400,000	27,500,000	27,600,000	27,700,000	27,800,000	27,900,000	28,000,000	28,100,000	28,200,000	28,300,000	28,400,000	28,500,000	28,600,000	28,700,000	28,800,000	28,900,000	29,000,000	29,100,000	29,200,000	29,300,000	29,400,000	29,500,000	29,600,000	29